SONY®

Interface Manual

LDM-1500

LDP-1500 Series Videodisc Player

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Chapter 1
General

COMMAND LIST

	0	1	2	3	4	5	6	7	8	9
0				0	ENTER	INDEX ON	ADDR INQ			
1	COMPLE-TION			1	C.E.	INDEX OFF	CONTINUE	NON C.F. PLAY		
2	ERROR			2	MENU		MOTOR ON	ROM VER-SION INQ		
3	LID OPEN			3	SEARCH		MOTOR OFF	MARK SET		
4			AUDIO MUTE ON	4	REPEAT			EJECT ENABLE		
5	NOT TARGET		AUDIO MUTE OFF	5		FRAME # MODE		EJECT DISABLE		
6	NO FRAME NUMBER		VIDEO OFF	6	CH-1 ON	C.L.		CHAPTER # INQ		
7	MARK RETURN		VIDEO ON	7	CH-1 OFF		STATUS INQ			
8			PSC ENABLE	8	CH-2 ON					
9			PSC DISABLE	9	CH-2 OFF		CHAPTER # MODE			
A	ACK		EJECT	F-PLAY	R-PLAY	MEMORY				
B	NAK		FWD STEP & STILL	F-FAST	R-FAST	M-SEARCH				
C			REV STEP & STILL	F-SLOW	R-SLOW					
D				F-STEP	R-STEP					
E				F-SCAN	R-SCAN		CX ON			
F				STOP	STILL		CX OFF			

▨ Return code, not executable command

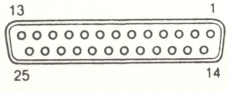
COMMUNICATION VIA RS-232C INTERFACE

INTRODUCTION

The RS-232C is the EIA standard which designates the interface connector for communication between a modem and a terminal device. Through this interface, the data is transferred in serial format bit by bit from one device to another.
The RS-232C interface is popular and available with most microcomputers, which results in their wide application.
The interface connector is located on the rear panel of the videodisc player.

SIGNAL CONNECTION

Connector Pin Assignment and Input/Output Signals
The signals are as follows:



Pin No.	Signal	Description	Signal Direction
1	FG	Frame ground	Non
2	TxD	Transmit data	LDP → Ext. CPU
3	RxD	Recieve data	LDP ← Ext. CPU
4	RTS	Request to send	LDP → Ext. CPU
5	CTS	Clear to send	LDP ← Ext. CPU
6	DSR	Data set ready	LDP ← Ext. CPU
20	DTR	Data terminal ready	LDP → Ext. CPU
7	GND	Signal ground	Non

Each signal conforms to the RS-232C specifications.
(Output level ON: more than +5V, OFF: less than −5V)

Standard and "null modem" cables

The RS-232C interface for the videodisc player has been set up to appear as a terminal to the external computer's serial interface. The cable requirements are determined by whether the configuration of the external computer's RS-232C is to be connected to a modem (DCE = Data Communications Equipment) or to a terminal (DTE = Data Terminal Equipment). **Check the RS-232C pin assignment of the external computer to be connected.**

Standard cable connection

If the configuration of the RS-232C on the external computer appears in the modem mode (to be connected to a terminal), a standard cable is required.

The cable configuration is as follows:

External CPU			Videodisc player
FG	1	1	FG (Frame Ground)
TxD	2	2	TxD (Transmit Data)
RxD	3	3	RxD (Recieve Data)
RTS	4	4	RTS (Request to Send)
CTS	5	5	CTS (Clear to Send)
DSR	6	6	DSR (Data Set Ready)
DTR	20	20	DTR (Data Terminal Ready)
GND	7	7	Ground

"Null modem" cable connection

If the configuration of the RS-232C on the external computer appears in the terminal mode (to be connected to a modem), a "null modem" cable is required. It is so called because there is no modem in the link. This cable is different from the standard cable in that lines are wired to cross the needed pins. The practical result is that the videodisc player appears as a terminal to the external computer.

The cable configuration is as follows:

External CPU			Videodisc player
FG	1	1	FG (Frame Ground)
TxD	2	2	TxD (Transmit Data)
RxD	3	3	RxD (Recieve Data)
RTS	4	4	RTS (Request to Send)
CTS	5	5	CTS (Clear to Send)
DSR	6	6	DSR (Data Set Ready)
DTR	20	20	DTR (Data Terminal Ready)
GND	7	7	Ground

DATA FORMAT

The factory-preset data format is as follows:

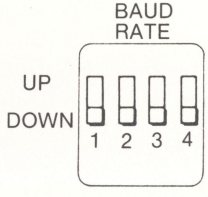
Mode:	Asynchronous
Character length:	8 bits
Baud rate:	1200 bps
Parity check:	None
Stop bit:	1 bit
Bit order:	Least significant bit first

To change factory pre-settings

The mode, character length, parity check and stop bit are fixed and cannot be changed.

Baud rate selection

Selectable baud rates are 9,600, 4,800, 2,400 and 1,200 bits/sec. Set the BAUD RATE selector located on the rear of the player to match the baud rate of the external computer.



Switch settings				Baud rate
1	2	3	4	
Up	Down	Down	Down	1200
Down	Up	Down	Down	2400
Down	Down	Up	Down	4800
Down	Down	Down	Up	9600

COMMUNICATION PROTOCOL

The videodisc player communicates with an external computer performing software handshake operation. When the player receives a code (in one byte) from an external computer, it returns a handshake return code such as ACK, NAK or ERROR to an external computer. The computer can then transmit a next code (in one byte) to the player. This is a rule for the communication protocol between the player and an external computer through the RS-232C port.

The followings are the description of the handshake return codes:

ACK (0AH)

ACK (0AH) (for Acknowledge) is returned from the player when a valid command has been received and the player is ready to receive a next code. The operation induced by a code sent will be executed.

Note

This code is returned twice to a single command from an external computer in the following cases as exceptions.

1. When the **MOTOR ON** command is sent after the player is stopped by the MOTOR OFF command:
   The first ACK is returned when the player receives the MOTOR ON command, and the second ACK after the spindle motor comes up to the nominal speed and the player becomes ready to operate.
2. When the **MOTOR OFF** command is sent when the player's motor is on:
   The first ACK is returned when the player receives the MOTOR OFF command, and the second ACK after the videodisc is supported by the tray.

NAK (0BH)

NAK (0BH) (for No Acknowledge) is returned from the player when a received command is not accepted.
The NAK code means either that the player is not in a status to receive a command or that the command is an undefined code.

ERROR (02H)

This code is returned when an RS-232C communication error (parity error, framing error, or overrun error) occurs.

Exceptional Formats in Communication Protocol

1. For **inquiry codes** such as ADDR INQ, STATUS INQ, etc., a set of bytes are returned one by one and no ACK is returned from the player.

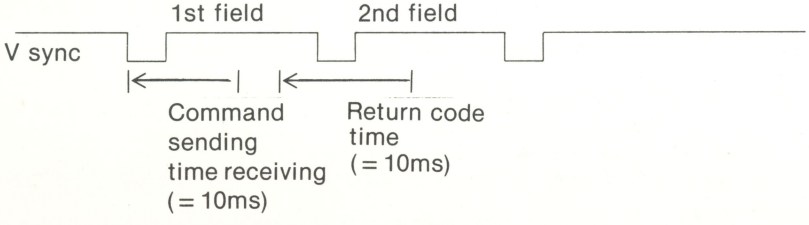
2. When SEARCH or REPEAT operation is performed, the COMPLETION code is returned at the end of the operation. If a command is sent before COMPLETION is returned, an ACK is returned in response to the command. As a result, an ACK and COMPLETION are both returned.

3. When the player must send a return code while sending data for an inquiry command, it waits until all the data are transmitted. Inquiry command data is not sent with a return code in between.

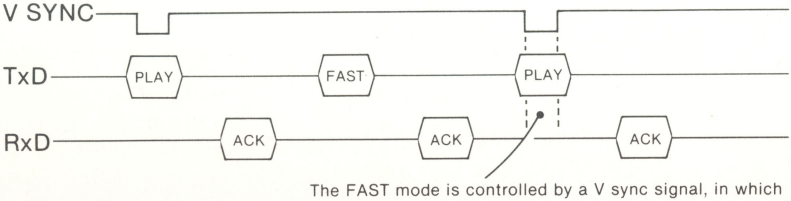
COMMAND EXECUTION TIME

The execution time is defined as the time required for receiving a command, returning ACK as long as the command is valid and entering the mode specified by the command. Timing for executing a command is not synchronized with a specific video signal.

The videodisc player begins execution of a command within 1/30th of a second (one frame). This means that if a command is sent by synchronizing to a V sync of the 1st field, the command will begin to be executed by the beginning of the next frame even though the RS-232C baud rate may be set to 1200 bps.

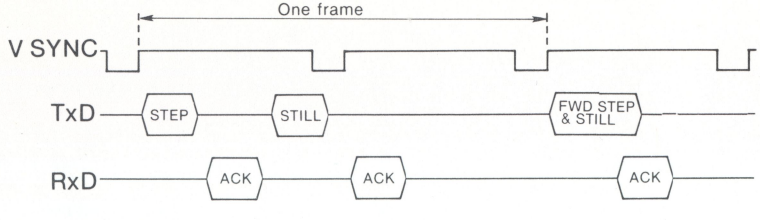


When the videodisc player receives commands in series, all the commands received may not be executed even though ACK is returned for each command transmitted.
As the case may be, for example, if the commands PLAY, FAST and PLAY are sent in series and the second PLAY is sent before FAST command is executed, the operation will result in mode PLAY and PLAY, and FAST mode will not be executed. This is because the FAST mode is servo controlled with a V sync signal and the second PLAY command was input before the V sync which should induce FAST mode enters.



The FAST mode is controlled by a V sync signal, in which PLAY command has been input in this example.

If a combination of a STEP and STILL commands (or FWD STEP & STILL or REV STEP & STILL command) is sent n times successively during step mode operation (sending a still picture by individual frames), a step operation may not occur n times as a result. To assure the correct operation, send a combination of the commands for the necessary number of times exactly for each frame.



POWER ON PROCEDURES

1. Connect the RS-232C interface connectors of the player and the external computer.
2. Initialize the external computer RS-232C port.
3. Activate the DTR line of the external computer so that the player's RS-232C can communicate with the external computer.
4. Turn on the player, and the EXT CPU indicator on the player will light up to show that the player is in the external control mode.
4. Press the OPEN/CLOSE button to open the disc compartment.
5. Set a disc and close the disc compartment. The player will come up to nominal speed within 15 seconds.
6. The player will enter the still mode with a CAV disc or stop mode with a CLV disc at the beginning of the program area.

Notes

- Once the player is in the EXT CPU mode, all function buttons on the front panel of the player or on the RM-2001 remote control unit are inoperative.
- After the player's power is turned on with the RS-232C communication link set ready, be sure to clear the receive buffer of the external computer.

To switch to the manual operation mode

To switch from the EXT CPU control mode to the manual control mode without turning off the player, set the DTR line of the external computer to Low or disconnect the RS-232C interface cable.
The manual control enables operation with the function buttons on the player or on the RM-2001 optional remote control unit.

TROUBLE SHOOTING

1. Tester for the RS-232C communication line:
   Tektronix Model 834, 834R
   This is an extremely powerful and low-cost Programmable Data Communications Tester.

2. When the Tektronix tester is not available:
   i. Confirm that the baud rate, stop bit, character length and baud rate factor are set correctly on the external computer.
   ii. Check the voltages of the TxD and RxD lines. These should be lower than −8V.
   iii. Check the voltages of the DTR and DSR lines (also CTS and RTS lines if exist on the external computer). These should be higher than + 8V.
   iv. Transmit data from the computer, and check the voltage of the TxD and RxD lines. These should be higher than + 8V.

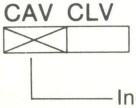
Chapter 2
LDP-1500 Series Control Commands

INTRODUCTION

This section provides an explanation of each command, listed in alphabetical order. Each page heading shows whether the associated command is valid for CAV and CLV discs. This information is provided in the format which is shown in the example below.
Each command has a description of its function and parameters, caution notes and programming hints, and a program example. The 8 bit commands are represented as hexadecimal numbers. All commands are provided in the section "Command List".

Example
Command STILL can be used with a CAV videodisc.

STILL (4FH)



Indicates that this command can be used with a CAV disc.

CAV CLV

ACK (0AH) — Acknowledge receipt of a command

An ACK is returned from the player when a valid command has been received and the player is ready to receive a next code. The appropriate operation will be executed or will begin to be executed.

ACK is a feedback code returned from the videodisc player. It is not an executable command.

For details, refer to the section "Communication via RS-232C Interface, Communication Protocol".

ADDR INQ (60H) — Inquire for current address

ADDR INQ is a request that the player return the current location address. For a CAV disc, this address is a frame number. For a CLV disc, this address is a time code number.

The frame number is represented by 5 bytes of ASCII code; the 1st byte is the MSD (most significant digit) and the 5th byte is the LSD (least significant digit).

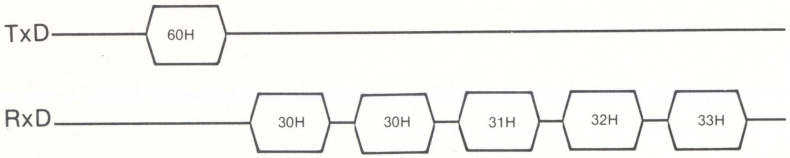
The time code is represented in a 5-byte ASCII code. For a CLV disc, the five bytes indicate the hour (1 byte), minute (two bytes), and second (two bytes) in this order when an extended code exists; or the five bytes indicate the hour (one byte), minute (two bytes), 39H, and 39H when no extended code exists.

Notes

- If the motor is off or no disc has been loaded when this command is received, NAK is returned.
- When the player receives ADDR INQ command, it does not accept the next command until having transmitted 5 bytes of data.

Program example

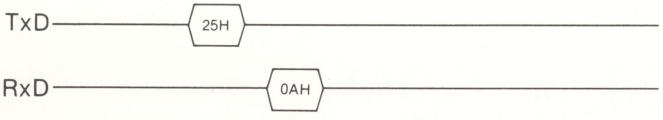
When the current frame number is 00123:



AUDIO MUTE OFF (25H) — Cancel audio muting
AUDIO MUTE ON (24H) — Mute audio output

AUDIO MUTE OFF and AUDIO MUTE ON respectively activates and deactivates the audio output while the player is in the FAST, SLOW, STEP, SCAN, R-PLAY and SEARCH modes. The default mode is AUDIO MUTE ON and is automatically selected when the power is turned on. Unless audio feedback is required during FAST, SLOW, STEP and SCAN, there is no need for these commands in most applications. Both the left and right channels of the player are affected concurrently.

Program example
To cancel audio muting:



C.E. (41H) — Clear entry

C.E. clears the last datum entered. The command is valid only for numerical data inputs.

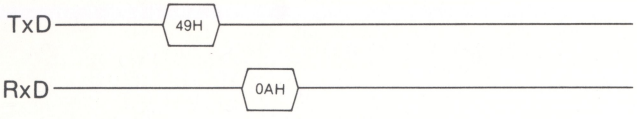
CH-1 ON (46H) — Turn CH-1 on
CH-1 OFF (47H) — Turn CH-1 off
CH-2 ON (48H) — Turn CH-2 on
CH-2 OFF (49H) — Turn CH-2 off

CH-1 ON, CH-2 ON, CH-1 OFF, CH-2 OFF will turn the corresponding audio channel on or off, regardless of the current state of the audio channel.
CH-1 ON and CH-2 ON respectively activate channel one and two.
CH-1 OFF and CH-2 OFF respectively deactivate channel one and two.

Audio output and the CH-1 or CH-2 status

Channel status		Output signal	
CH-1	CH-2	L connector	R connector
ON	ON	Channel 1	Channel 2
ON	OFF	Channel 1	Channel 1
OFF	ON	Channel 2	Channel 2
OFF	OFF	Muting	Muting

Program example
To deactivate the audio channel 2:



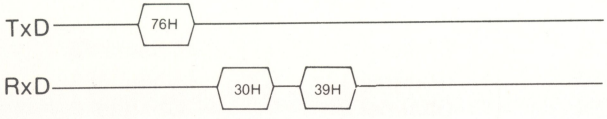
CHAPTER # INQ (76H) — Inquire for current chapter number

The CHAPTER # INQ command requests the player to send the current chapter number.

A chapter number is represented in a 2-byte ASCII code. The 1st byte is a most significant byte (MSB) and the 2nd byte is the least significant byte (LSB).

If this command is received for a disc with no chapter numbers, NAK is returned.

Program example



CHAPTER # MODE (69H) — Set to chapter number mode

CHAPTER # MODE sets the player in the chapter number mode. A disc with chapter numbers recorded on it can then be accessed based on a chapter number. When the index function is activated, the present chapter number is displayed.

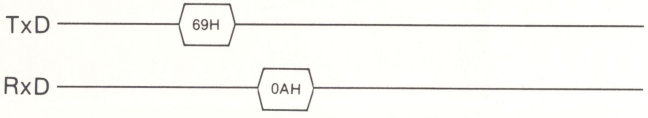
Refer to FRAME # MODE when access of a videodisc by frame numbers or time code is desired.

Notes

- If the disc does not have chapters recorded, NAK will be returned.
- Once the player enters the CHAPTER # MODE, the mode will remain until another number mode command is input.

Program example

To set the player in CHAPTER # MODE:



C.L. (56H) — Clear all

C.L. clears the mode when the player is in SEARCH mode or REPEAT mode. The player returns to an initial state and enters into STILL mode with a CAV disc and PLAY mode with a CLV disc as far as the disc is loaded in focus. The player now can accept any command. This command takes priority over any other command.

COMPLETION (01H) — Complete a specified operation

COMPLETION is returned by the videodisc player to notify the external computer of the successful completion of SEARCH, REPEAT and M-SEARCH operations.
When this code is returned for a CAV disc, the specified target frame (or chapter) number is displayed in the still mode if search operation is being performed or the specified last frame (or chapter) number is displayed in the still mode if repeat operation is being performed. With a CLV disc, normal playback begins from the target time (or chapter) number in search operation and from the end time (or chapter) number in repeat operation.

Refer to the code NOT TARGET for the complementary return code.

COMPLETION is a feedback code returned from the videodisc player. It is not an executable command.

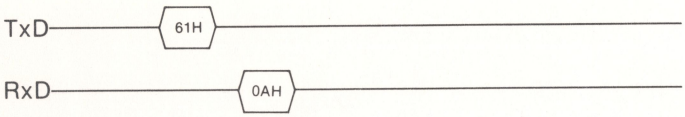
CONTINUE (61H) — Resume the mode prior to STILL

CONTINUE returns the player to the mode it was in before the STILL command was given. If this command is input with no STILL command transmitted beforehand, NAK is returned.

Notes

- If the commands are input as STILL, STILL, PLAY, CONTINUE, the player will enter the STILL mode.
- The SEARCH operation interrupted by STILL command cannot be resumed by CONTINUE command. The player will enter STILL mode at that point.
- The REPEAT operation interrupted by STILL command can be resumed by CONTINUE.

Program example



CX ON (6EH) — Activate CX system
CX OFF (6FH) — Deactivate CX system

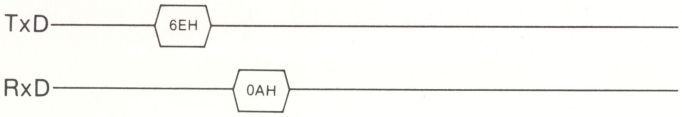
These set of commands control the CX noise reduction system which greatly improves the dynamic range of audio signal.

CX ON will activate the CX noise reduction system, regardless of its current state. CX OFF will turn the system off or keep it in the off state.

Note
These commands are not effective on videodiscs which have recorded on them a special code to activate the CX noise reduction system automatically.

CX is a trademark of CBS.

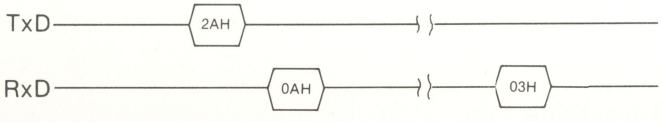
Program example
To activate CX system:



EJECT (2AH) — Open the disc compartment

The EJECT command opens the disc compartment. After the operation is completed, the player issues feedback code LID OPEN (03H). If the EJECT command is sent to a player with its disc compartment already open, the player returns NAK (0BH). If this command is sent to a player immediately after turning the power on with its disc compartment open, the player returns two codes: ACK (0AH) and LID OPEN (03H)

If the EJECT command is sent to a player with its motor on, the disc compartment opens after the motor turns off, but the player does not issue feedback code ACK (0AH) after the motor has been turned off.

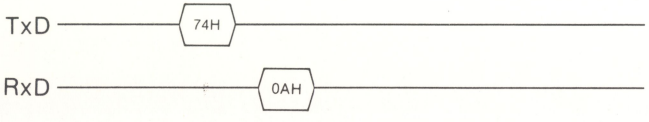


EJECT ENABLE (74H) — Activate eject function
EJECT DISABLE (75H) — Deactivate eject function

The EJECT ENABLE command validates the lid OPEN/CLOSE button of the player. The player is in the ENABLE mode immediately after power-on.

The EJECT DISABLE command validates the lid OPEN/CLOSE button of the player. After this command is executed, the player does not enter into the ENABLE mode unless an EJECT ENABLE command is executed or the power is turned off.

Program example
To enter EJECT ENABLE mode:



ENTER (40H) — Terminate a command

ENTER is a command which is used as an end marker for the input of parameters for various commands. SEARCH, REPEAT, STEP and MARK SET utilize the ENTER command. These commands will begin to be executed at the time the player receives one (or more) ENTER command(s).

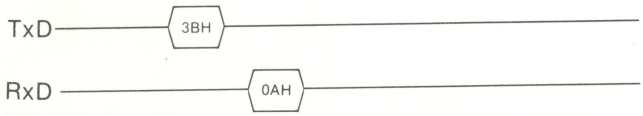
ERROR (02H) — Error condition raised

This ERROR code is returned if an RS-232C communication error (parity error, framing error, or overrun error) occurs.
If the same error occurs repeatedly, different baud rates may have been set on the computer and LDP player sides.

F-FAST (3BH) — Fast forward play
R-FAST (4BH) — Fast reverse play

The FAST commands set the player in fast playback mode (3 times the normal speed).
F-FAST is for forward direction and R-FAST for reverse direction.

Program example
To play at fast speed in forward direction:

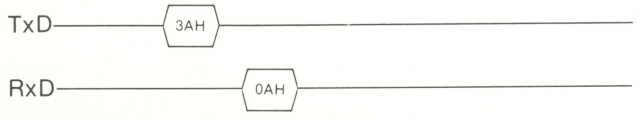


F-PLAY (3AH) — Normal forward play
R-PLAY (4AH) — Normal reverse play

The PLAY commands set the player in normal playback mode. F-PLAY initiates playback in the forward direction playback and the R-PLAY in the reverse direction.

*With a CLV disc, R-PLAY is not possible.

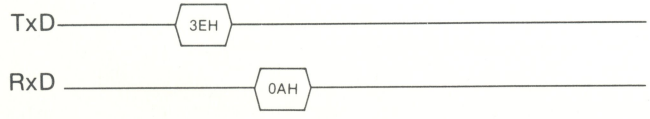
Program example
To play at normal speed in forward direction:



F-SCAN (3EH) — Scan in forward
R-SCAN (4EH) — Scan in reverse

The SCAN commands set the player in SCAN playback (approximately 100 times normal playback). F-SCAN is SCAN playback in the forward direction and R-SCAN is SCAN playback in the reverse direction.

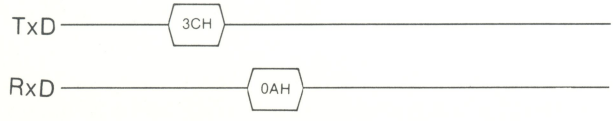
Program example
To scan the picture in forward direction:



F-SLOW (3CH) — Slow forward play
R-SLOW (4CH) — Slow reverse play

The SLOW commands set the player in SLOW motion playback (1/5 of normal speed). F-SLOW is SLOW playback in the forward direction and R-SLOW is SLOW playback in the reverse direction.

Program example
To play at slow speed in forward direction:



F-STEP (3DH) — Variable forward play
R-STEP (4DH) — Variable reverse play

The STEP commands set the player in a variable (slower than normal) playback. F-STEP is variable forward playback and R-STEP is variable reverse playback. The variable slow playback has a range from 1/1 to 1/255 normal speed playback. The STEP commands give as parameters the playback speed and is specified by the denominator. The range is 1 to 255 and is represented by ASCII codes. This parameter is then followed by the command ENTER (40H). If "0" is selected as the denominator, the result is the same as a STILL (although "FWD STEP" is displayed when the INDEX function is activated).

To advance the videodisc by one frame, send a F-STEP and a STILL (or R-STEP and STILL) command. To advance the videodisc by "n" frames, send a STEP/STILL command for "n" times. For details, refer to the section "Communication via RS-232C, Command Execution Time."

Seconds of display per frame for various step speeds

(NTSC)

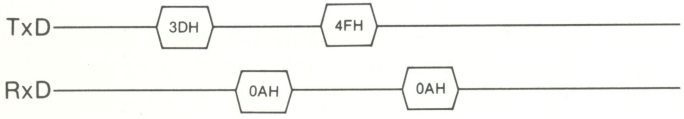
1/1 *	0.033 sec	1/120	4.0 sec
1/2	0.066	1/150	5.0
1/3	0.1	1/180	6.0
1/10	0.33	1/210	7.0
1/30	1.0	1/240	8.0
1/60	2.0	1/255	8.5
1/90	3.0		

(PAL)

1/1 *	0.04 sec	1/125	5.0 sec
1/2	0.08	1/150	6.0
1/3	0.12	1/175	7.0
1/10	0.4	1/200	8.0
1/25	1.0	1/225	8.5
1/50	2.0	1/250	10.0
1/75	3.0	1/255	10.2
1/100	4.0		

*The same speed as normal PLAY mode but audio output is muted.

Program example
To advance the picture by one frame and still the picture:

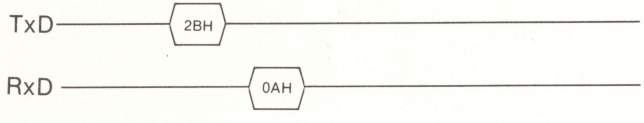


FWD STEP AND STILL (2BH) — Advance one frame forward and still
REV STEP AND STILL (2CH) — Advance one frame backward and still

The FWD STEP AND STILL command causes a stilled CAV disc to step one frame forward and still again. If this command is received in the nonstill mode, the disc stills at the frame succeeding the one receiving the command.

The REV STEP AND STILL command causes a stilled CAV disc to step one frame backward and still again. If this command is received in the nonstill mode, the disc stills at the frame preceding the one receiving the command.

Program example
To advance one frame forward and still:

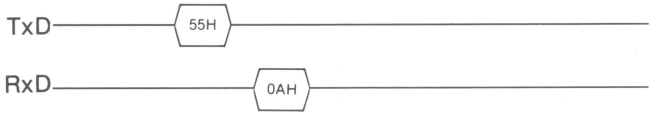


FRAME # MODE (55H) — Set to frame number mode

When a CAV disc is used, FRAME # MODE sets the player in the frame number mode. A CAV disc with frame numbers recorded on it can then be accessed based on a frame number. When a CLV disc with time numbers recorded is used, this command sets the player to be accessed based on a time number.

To directly input number mode of a videodisc, CHAPTER # MODE (69H) is provided in addition.

Program example
To set the player in the frame number mode:



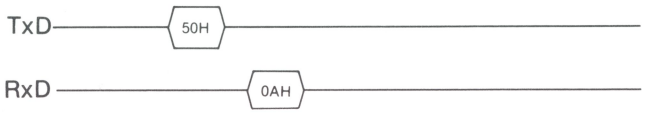
INDEX ON (50H) — Activate index function
INDEX OFF (51H) — Deactivate index function

The INDEX commands enable the display, on the monitor screen, of the videodisc player operating status and current videodisc playback address. When inputting the commands for SEARCH and REPEAT operations, the process is displayed in place of the current operating mode and address.

INDEX ON activates the index function regardless of current index display status. The command will be accepted at any time.

INDEX OFF deactivates the index function regardless of the current display status. The command will be accepted at any time.

Program example
To activate index function on the display:



LID OPEN (03H) — Inform of lid open

An LID OPEN is returned when the motor is stopped and usually the disc compartment is open.

LID OPEN is a feedback code returned from the videodisc player. It is not an executable command.

MARK RETURN (07H) — Mark set position is found

The MARK RETURN (07H) is returned when a mark set position is read in the MARK SET mode. If the marked data is outside the mark sending position, this code is returned when the current address is recognized to be the mark data or more; if the marked data is inside the mark sending position, this code is returned when the current address is recognized to be the mark data or less.

The MARK RETURN is a feedback code returned from the videodisc player. It is not an executable command.

MARK SET (73H) — Set mark position

The MARK SET command causes the LDP to output MARK RETURN CODE (07H) when the set position is read.

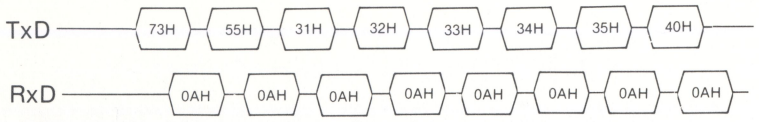
When the player is in the frame number mode, a frame number can be marked for a CAV disc and a time code can be marked for a CLV disc; when the player is in the chapter number mode, a chapter number can be marked.

If a CL command (56H) is received before passing the mark time, the mark time is reset and no MARK RETURN CODE is returned.

Specify the mark data in the ASCII code. Before ENTER (40H) is input, effective data is as follows:
FRAME ... 5 low-order positions
EXTENDED TIME CODE ... 5 low-order positions
NOT EXTENDED TIME CODE ... 3 low-order positions
CHAPTER NUMBER ... 2 low-order positions

Note
The mode when the MARK SET has been input remains effective even when the mode is changed afterwards. For example, if the chapter 10 is assigned as mark position in the chapter number mode and the mode is changed to the frame number mode, the mark position "chapter 10" remains.

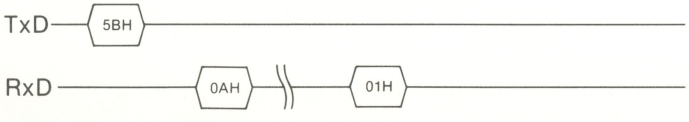
Program example
Mark frame number = 12345



M-SEARCH (5BH) — Locate the memorized location

M-SEARCH locates the address which is memorized by MEMORY and sets the player into STILL mode with a CAV disc and F-PLAY (normal playback) mode with a CLV disc.

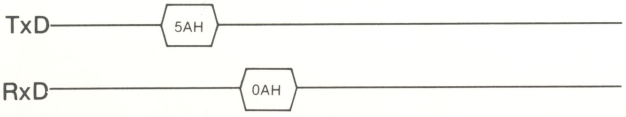
When the M-SEARCH command is executed, the player enters into the mode memorized with the MEMORY command. For example, if a chapter number has been memorized with a MEMORY command and the M-SEARCH command is executed in the frame number mode, the player enters into the chapter number mode.



MEMORY (5AH) — Memorize the current location

In the frame number mode, the MEMORY command allows the player to memorize the frame number (CAV disc) or the time code (CLV disc) of the location being played when this command is received. In the chapter number mode, this command allows the player to memorize the chapter number.
The memorized location address is located by the M-SEARCH command explained before.

Note
The memorized location cannot be cleared unless otherwise the next memory is issued.

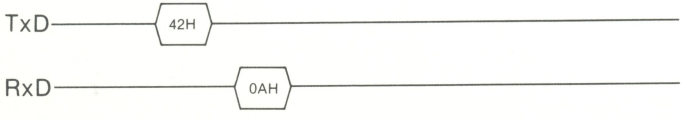


MENU (42H) — Search for program area heading

The MENU command causes to play from the beginning of the program area.

If this command is received during the search input mode, repeat input mode, or mark time setting, NAK is returned.

If this command is sent during search or repeat operation, the operation is cleared and the player plays from the beginning of the program.



MOTOR OFF (63H) — Stop spindle motor
MOTOR ON (62H) — Start up spindle motor

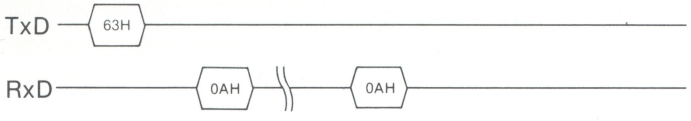
These set of commands control the spindle motor of the videodisc player. Different from most of commands, these induce the player to return ACK code twice. Refer to the section "Communication via RS-232C, Communication Protocol."

MOTOR OFF stops the spindle motor and returns the laser pickup head to the home position. When the motor stops, the video output will be muted. This command is valid only while the motor is on.
When the player receives the MOTOR OFF command, it returns an ACK code and then stops the motor. The disc is then supported by the tray and the DISC PROP status bit is set. The player returns ACK again and is ready to receive function commands.

MOTOR ON starts up the player's spindle motor after it is stopped by the MOTOR OFF command. This command can be executed only when the motor is off. If the disc compartment is open when this command is received, it will be closed automatically.
When the player receives MOTOR ON, it returns ACK code and when the spindle motor comes up to the nominal speed, it returns ACK code again. The INIT status bit remains set during this period.

Note
The player returns a NAK when receiving the following commands:
1. MOTOR OFF before returning the second ACK in the motor on state
2. MOTOR ON before returning the second ACK in the motor off state
3. MOTOR ON when the player is in motor on state
4. MOTOR OFF when the player is in motor off state

Program example
To stop the player's spindle motor:



NAK (0BH) — Reject receipt of a command

The NAK code is returned when the player rejects the command sent. In this case, check the current player status or the contents of the command sent, then send the command in the correct timing or sent the correct commands.

NAK is a feedback code returned from the videodisc player. It is not an executable command.

NO FRAME NUMBER (06H) — Target frame is illegal

NO FRAME NUMBER is returned when a specified frame (time code, chapter) to be searched for is not in the active video frame range. When such illegal frame number is specified, the player will continue searching for a while. When the lead-in area is accessed while searching, the player stills (for a CAV disc) or plays (for a CLV disc) near the beginning of the program area. When the lead-out area is accessed while searching, the player stills (for a CAV disc) or plays (for a CLV disc) near the end of the program area.

NO FRAME NUMBER is a feedback code returned from the videodisc player. It is not an executable command.

Notes

- NO FRAME NUMBER is not returned in repeat operation with the frame number mode. If the illegal number is specified, the repeat operation is executed between the specified legal frame number and the first found frame number after/before the illegal number, and COMPLETION is returned when the operation ends.
- If a focus error or tracking error occurs when accessing the lead-out area of an abnormal disc, the player may return to the beginning of the program area and enter into the STOP mode.

NON C.F. PLAY (71H) — Disengage color framing

NON C.F. PLAY disengages the color framing when the player is set in the normal playback mode from FAST, SLOW or STILL mode. (When color framing occurs, a few tracks are skipped, which affects digital data reading.) This command is necessary only with the PAL version. On the NTSC player, the command has the same function as F-PLAY (3AH).

NOT TARGET (05H) — Target frame not found

NOT TARGET is returned in place of COMPLETION when the target frame (time code, chapter) could not be found in the search operation. The inability to access the target frame may be due to a defect on a videodisc itself or the player whose optics could have too much dust or focusing and tracking mechanisms may be out of alignment.

NOT TARGET is a feedback code returned from the videodisc player. It is not an executable command.

Note
NOT TARGET is not returned in repeat operation. If the target point is not found, the player will recognize the first found frame number after/before the specified number, and COMPLETION is returned when the operation ends.

Numeric commands 0 — 9 (30H — 39H)

30H to 39H represents numerical data. These are used to specify the parameters in the following applications. When these codes are entered, the ENTER command (40H) should follow the data.

1.	SEARCH :	Frame # input
		Chapter # input
		Time # input
2.	REPEAT :	Frame # input
		Chapter # input
		Time # input
		# of repetitions input
3.	STEP :	Auto step times input
4.	MARK SET :	Mark time input

PSC ENABLE (28H) — Enable picture stop code
PSC DISABLE (29H) — Disable picture stop code

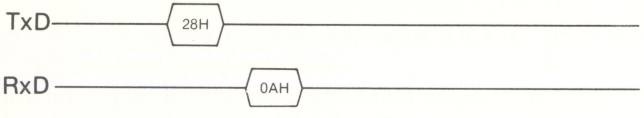
The PSC ENABLE command enables picture stop codes recorded on a disc. In the ENABLE mode, the screen stills when a picture stop code is detected during operation other than search and scan. The player is in the ENABLE mode immediately after power-on.

The PSC DISABLE command disables picture stop codes recorded on a disc. In the DISABLE mode, the screen does not still even when a picture stop code is detected.

After PSC DISABLE command is executed, the player does not enter into the ENABLE mode unless a PSC ENABLE command is executed or the power is turned off.

Note
A picture stop code is valid only for a CAV disc, though it is accepted for a CLV disc (0AH is returned).

Program example
To enable picture stop code:



REPEAT (44H) — Playback a designated sequence

REPEAT allows the playback of a designated sequence for a designated number of times at a designated playback speed. REPEAT play is performed between two specified frames or between two specified time codes or within a specified chapter.

The REPEAT command has various parameters. The first is the target end location. The second is the number of times the sequence should be REPEATed. Both parameters must be sent as ASCII representations (30H = 0 to 39H = 9). After each parameter is entered, the command ENTER (40H) must be sent. The starting point is defined as the point at which the REPEAT command is received by the videodisc player.
Usually a starting address is SEARCHed for before defining the REPEAT sequence. If the target frame number is less than the starting frame number, the sequence will be played back in REVERSE. The range for the number of times the sequence is to be REPEATed is 0 to 99. The default value, when no number is specified, is 1. When 0 is specified, the sequence will be REPEATed until it is interrupted by a C.L.

Once a REPEAT command (44H) is sent, the player will stop and display in STILL mode the nearest frame it is playing back on a CAV disc. With a CLV disc, the current mode continues until ENTER command is input and then the player enters REPEAT mode.

When the REPEAT operation is completed, the player will enter the STILL mode with a CAV disc, and PLAY mode with a CLV disc. Feedback code, COMPLETION, is returned as appropriate.

To set the desired number mode in repeat operation
If the player is not in the mode in which the REPEAT operation is to be performed, send the desired command FRAME # MODE (55H) or CHAPTER # MODE (69H).

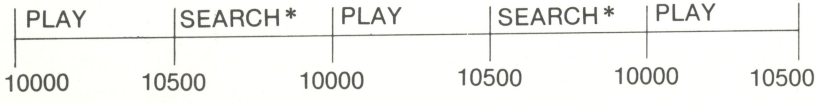
To set the desired playback mode during a REPEAT operation (applicable with CAV discs only)
The default playback mode is either F-PLAY or R-PLAY, depending on whether the target ending frame is greater or less than the starting address. If other playback modes are desired, send the appropriate playback speed command (such as F-FAST, F-STEP) after the command REPEAT **and** before the target frame is designated. An ENTER should come right after the playback speed command.
Only forward direction playback modes are valid. Direction is determined by whether the target frame is greater or less than the beginning frame number.
If the STEP mode is specified, it is necessary to select a step speed from 1/1 to 1/255 of normal speed. For details, refer to "Basic commands, STEP (3DH, 4DH)." If the step speed is not specified, STILL mode is selected automatically.

To stop the operation before all repetitions are completed
Send C.L. (56H) command. The REPEAT mode is cleared and any other command can be accepted. The player enters STILL mode on a CAV disc and enters F-PLAY mode on a CLV disc.

Return code in repeat operation
The code COMPLETION (01H) is returned when the operation completes to the end or in a way for some reason, whether the target frame (or time) is found or not.

Commands executed during repeat operation
During the execution of a REPEAT sequence, the speed of playback can be changed by executing one of the commands listed below (playback commands). When in the process of SEARCHing to the beginning address of a REPEAT sequence, these playback commands cannot be executed. Non playback commands such as CH-1 ON or STATUS INQ can be executed.

For example: REPEAT 10,000-10,500 PLAY 3 times



*During SEARCH period, only non playback commands can be executed.

Function commands:
F/R PLAY
F/R FAST
F/R SCAN
F/R SLOW
F/R STEP
STOP
STILL
NON C.F. PLAY

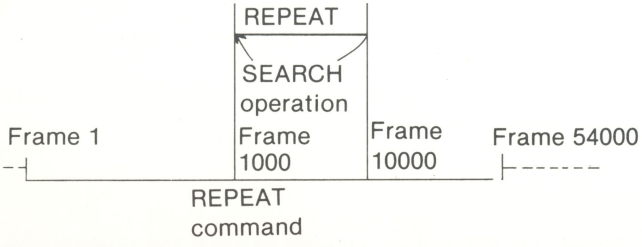
REPEAT OPERATION ACCORDING ACCESS MODE

FRAME # MODE (CAV)

When a sequence is REPEATed once, the player will playback from a still frame (the result of a SEARCH or the entry of REPEAT command, which results in still mode) to the target frame.

When the number of REPEATs is more than one, the player will playback through one frame before the target and then SEARCH to the beginning frame number. At the end of the REPEAT sequence, the player will stop on the target frame in STILL mode.

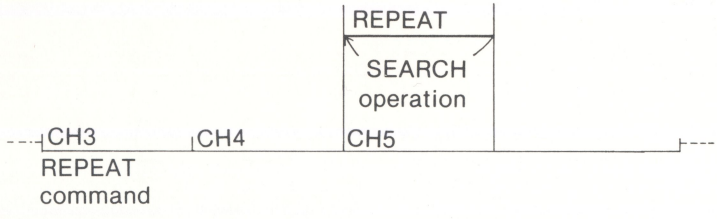
For example: target frame # 10000



CHAPTER # MODE (CAV, CLV)

The player will REPEAT the chapter that is specified from beginning to end **regardless of its current position.**

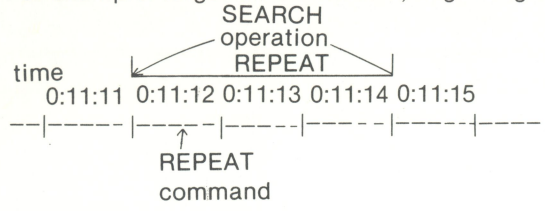
For example: target chapter # 5, beginning chapter # (not req.)



TIME # MODE (CLV)

In CLV time number mode, the REPEAT operation is **seconds accurate**. The beginning point is determined by the position at which the REPEAT is sent to the disc player.

For example: target time # 0:11:15, beginning time #0:11:12



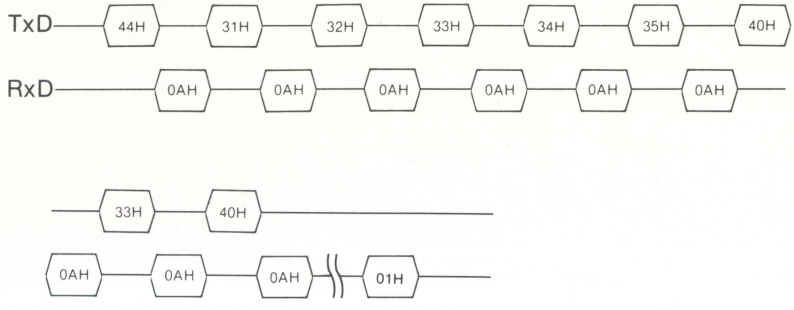
In this example, the REPEAT is sent at 0:11:12:10 (hour:min:sec:frame) and the beginning point is 0:11:12:00.
If the target location for the repeat is 0:13:00, then the player will go to 0:12:59:29 (NTSC) or 0:12:59:24 (PAL).

Note

To designate the last frame on a disc as target point in the time number mode repeat operation, it is required to enter the time not actually existing on a disc. For example, to designate the end time number as 29:59:29 (min:sec:frame) with the NTSC videodisc player, enter the target time as 30:00 (min:sec).

Program example

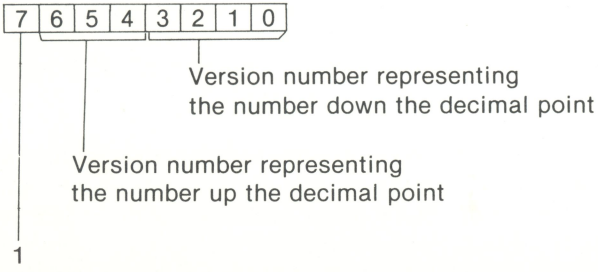
To repeat playback from the present frame number to the frame number 12345 for three times:



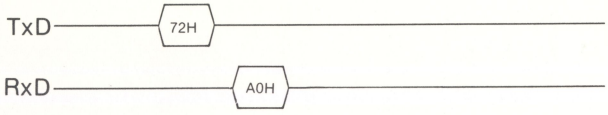
ROM VERSION INQ (72H) — Inquire ROM version

ROM VERSION INQ prompts the player to return the ROM version number for the videodisc player. The version number is represented by binary data.

The data format representing the ROM version number is as follows:


7 6 5 4 3 2 1 0
Version number representing
the number down the decimal point
Version number representing
the number up the decimal point
1

Program example
LDP-1500 version = 2.0



SEARCH (43H) — Locate target address

SEARCH prompts the player to locate a particular location on a videodisc. The target address is a frame number, time code number or chapter number. The target address is the ASCII representations (30H = 0 to 39H = 9). The address parameter must be followed by an ENTER (40H).

At the completion of a SEARCH, a feedback code is returned. It can be a COMPLETION, NOT TARGET or NO FRAME NUMBER. When the target point is located, the player will enter STILL mode with a CAV disc and PLAY mode with a CLV disc.

Once a SEARCH command is sent, the player will stop and display in STILL mode the nearest frame it is playing back on a CAV disc. With a CLV disc, the FWD PLAY mode continues until ENTER is input and then starts SEARCH operation.
If a SEARCH command is sent in the STOP mode, the player remains in the STOP mode.

To set the desired number mode in search operation
If the player is not in the mode in which the SEARCH operation is to be performed, send the desired command FRAME # MODE (55H) or CHAPTER # MODE (69H).

Possible results of a SEARCH operation

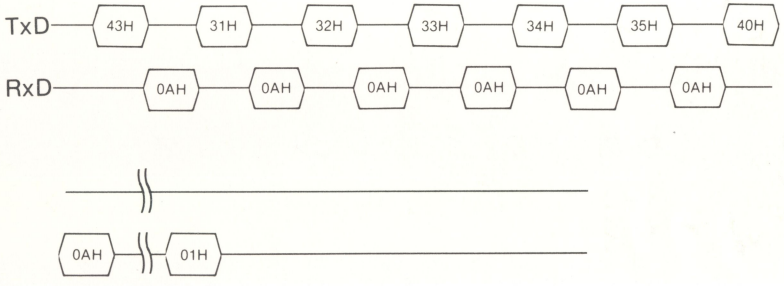
- COMPLETION (01H) is returned when target frame found; or target time code found; or target chapter number found (first frame or track of the chapter).
- When a lead-out signal is detected while searching for the target frame, the player stills (for a CAV disc) or plays (for a CLV disc) near the end of the program area and returns NO FRAME NUMBER (06H).
- In the same way, when a lead-in signal is detected, the player stills (for a CAV disc) or plays (for a CLV disc) near the top of the program area and returns NO FRAME NUMBER (06H).

To end the search operation

Send C.L. (56H) to end a SEARCH operation.

Program example

To search the frame number 12345:



STATUS INQ (67H) — Inquire status of player

STATUS INQ prompts the player to return its current status. The STATUS data is represented by 5 bytes of data; the 1st byte first and 5th byte last. This inquiry can be made any time that communication is possible.

Note
When the player receives STATUS INQ command, it does not accept the next command until having transmitted 5 bytes of data.

BIT ASSIGNMENT OF EACH BYTE OF STATUS DATA

1st byte

D7 : Always 1.

D6 : Search/repeat mode flag

1 = Player is physically SEARCHing or REPEATing.

D5 : Motor off mode flag

1 = Player motor is turned off by the MOTOR OFF command.

Note: If the disc compartment is ejected, this flag is reset = 0.

D4 : INIT flag

1 = Player is in the initialization state.

D3 : DISC PROP

1 = The disc is supported by the tray with the spindle motor off and with the clamp for the disc off. This condition is a result of a MOTOR OFF command or when the OPEN/CLOSE button is pressed. This status is different from MOTOR OFF, bit D5.

D2 : No disc flag

1 = No disc in the closed compartment.

D1 : Focus flag

1 = Optical pick up circuit is out of focus.

D0 : ERROR

1 = There was an erroneous command received.

From the above explanation, the spindle motor is rotating (and the player is ready to receive a control command) when MOTOR OFF is "0" and INIT is "0."

2nd byte

D7: Always 0.
D6: Always 0.
D5: Always 0.
D4: Always 0.
D3: Always 0.
D2: Always 0.
D1: Always 0.
D0: Always 0.

3rd byte

D7: Always 0.
D6: 1 = Extended code found.
0 = Extended code not found.
D5: CAV/CLV disc
1 = CLV disc
0 = CAV disc
D4: Disc size
1 = 12" disc
0 = 8" disc
D3: Always 0.
D2: Always 0.
D1: Always 0.
D0: Always 0.

4th byte

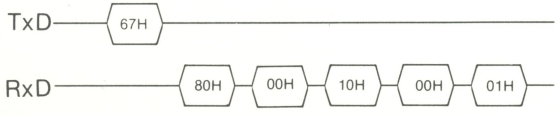
D7: Step number input
1 = Player is waiting for a number defining the various step speed.
D6: Always 0.
D5: Repeat times input
1 = The player is waiting for a number input of repeats.
D4: Always 0.
D3: Command out for picture stop code
1 = The player is in STILL mode as result of a picture stop code.
D2: Repeat mode
1 = The REPEAT command was received; this remains set during repeat input mode. Once playback begins, the flag is set to 0. See bit D6 of the 1st byte.
D1: Search mode
1 = The SEARCH command was received; this remains set during search input mode. Once searching begins, the flag is set to 0. See bit D6 of the 1st byte.
D0: Number input
1 = The player is waiting for a number input for the search, repeat or mark-set operation.

5th byte (command status)

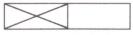
D7 : Playback direction
1 = Reverse play, 0 = Forward play
D6 : Stop mode 1 = Stop mode
D5 : Still mode 1 = Still mode
D4 : Scan mode 1 = Scan mode
D3 : Step mode 1 = Step mode
D2 : Slow mode 1 = Slow mode
D1 : Fast mode 1 = Fast play mode
D0 : Play mode 1 = Normal play mode

Program example

Player's status—CAV, 12" disc, normal playback mode:



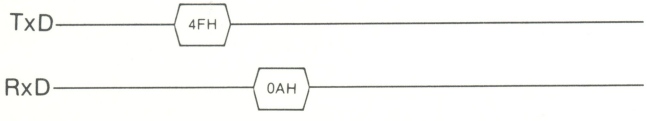
CAV CLV



STILL (4FH) — Still picture

The STILL command sets the player to display a freeze picture. Audio is muted in this playback mode.

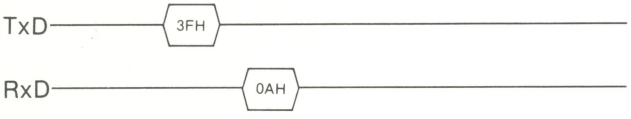
Program example
To still the picture:



STOP (3FH) — Halt video and audio playback

The STOP command halts the playback of a videodisc. Both audio and video are muted.

Program example
To mute video and audio output:

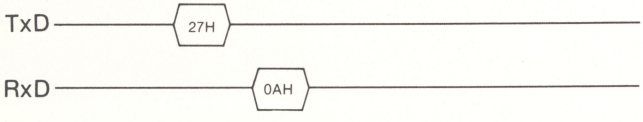


VIDEO ON (27H) — Output video signal while in active area
VIDEO OFF (26H) — Mute video output

This command causes the player to enter into the video output muting mode when the lead-in or lead-out area is accessed during searching, STOP mode operation, or power-on initialization and into the VIDEO signal output mode in other cases.
The player is in the VIDEO ON mode immediately after power-on.

The VIDEO OFF siganl keeps muting the video output. Playing in the VIDEO OFF mode causes to output only audio siganls.
After the VIDEO OFF command is executed, the player does not enter into the VIDEO ON mode unless a VIDEO ON command is executed or the power is turned off.

Program example
To enter VIDEO ON mode:



Chapter 3
Sample Programs

SONY HB-G900P VIDEO UTILITY COMMANDS

The HB-G900P personal computer is equipped with a video utility program which controls the LDP-1500 series videodisc players. The sample programs using the video utility program are provided below.

Notes

- The HB-G900P video utility program is based upon that of LDP-180 series and IF-180. The differences which occur when used with the LDP-1500 series are found in status data.
- The following LDP-1500 series commands are masked in the HB-G900P video utility program.
  69H: CHAPTER NUMBER MODE
  71H: NON COLOR FRAMING PLAY
  72H: ROM VERSION INQUIRY
  73H: MARK SET
  76H: CHAPTER NUMBER INQUIRY
- Make sure to send the command__LDPINIT before inputting the program with the HB-G900P video utility.

1. **To set the player in the PLAY mode after power-on procedure**
   (Player's status: MOTOR OFF = 0, INIT FLAG = 0, DISC PROP FLAG = 0, FOCUS FLAG = 0)

```
10    DIM S%(4)
20    __LDPSTAT(S%)
30    IF (S%(0)< >&H80) THEN 20
40    __LDPOUT (&H3A)
50    END
```

2. **To SEARCH for frame number 10,000**

```
10    __LDPSRCH (10000)
20    END
```

3. **To PLAY from frame 10,000 to 15,000 and STOP**

```
10    __LDPSTART (10000,15000,0)
20    __LDPEND
30    __LDPOUT (&H3F)
40    END
```

4. **To resume REPEAT PLAY if the lid of the disc compartment is opened during operation**

```
10    DIM S%(4)
20    _LDPSTAT(S%)
30    IF ((S% (0) AND&H40) = 0) THEN 100
40    _LDPSTAT (S%)
50    IF ((S%(0) AND&HBF) = &H80) THEN 40
60    _LDPSTAT (S%)
70    IF (S%(0)< >&H80) THEN 60
80    _LDPINIT
90    _LDPOUT (&H3A)
100   END
```

Note
If the image goes out of focus or the power is turned off while repeating, the program will be terminated.

5. **To activate/deactivate the audio channel at the designated frame number**

Example: 10000 10100 CH1 ON
10100 10200 CH2 ON
10200 CH1 and CH2 ON

```
10    DIM S% (4)
20    _LDPOUT (&H46)
30    _LDPOUT (&H49)
40    _LDPSRCH (10000)
50    _LDPEND
60    _LDPOUT (&H3A)
70    _LDPFRM (FRAME)
80    IF ((FRAME<10099)OR(FRAME>10101)) THEN 70
90    _LDPOUT (&H47)
100   _LDPOUT (&H48)
110   _LDPFRM (FRAME)
120   IF ((FRAME<10199) OR (FRAME>10201)) THEN 110
130   _LDPOUT (&H46)
140   _LDPOUT (&H3A)
150   END
```

Note
When controlling the player with an LDPFRM command, a tolerance of ±1 frame is necessary for the target frame.

SONY SMC-2000 BASIC/1 COMMANDS

SMC-2000 BASIC/1 provides extended statements to control the videodisc player (called disc extended statements).

Flow charts and SMC-2000 BASIC/1 routines to control the videodisc player are provided below. These sample programs are for reference purposes only. The actual programs you implement will depend on the microcomputer used, the BASIC implementation and your particular programming requirements.

Initial steps

>BASIC	Load BASIC
LINK "LDP.PAC"	Link of disc utility
__LDPINIT	1. Initialization of control lines
	2. Initialization of the videodisc player

1. **To set the player in the PLAY mode after power-on procedure**
   (Player's status: MOTOR OFF = 0, INIT FLAG = 0, DISC PROP FLAG = 0, FOCUS FLAG = 0)

```
10  DIM S%(4):S%(0) = &H3E
20  WHILE S%(0) = 0
30  __LDPSTAT (S%( ))
40  S%(0) = S%(0) AND &H3E
50  WEND
60  __LDPOUT (&H3A)
70  END
```

2. **To SEARCH for frame number 10,000**

```
__LDPSRCH (10000)
```

3. **To PLAY from frame 10,000 to 15,000 and STOP**

```
__LDPSTART (10000,15000,,,)
__LDPOUT (&H3F)
```

4. **To resume REPEAT PLAY if the lid of the disc compartment is opened during operation**

The SMC-2000 is provided with interrupt service routine which activates when the lid of the disc compartment is opened.

```
10      DIM S%(4):S%(0) = &H3E:OPENFLAG% = 0
20      ON IRQ(1) GOSUB2000
30      IRQ(1) ON
40      LDPSTART(10000,15000,,,)
50      IF OPENFLAG%<>0 GO TO 1000
60      STOP
1000    OPENFLAG% = 0
1010    WHILE S%(0) = 0
1020    LDPSTAT (S%( ))
1030    S%(0) = S%(0) AND &H3E
1040    WEND
1050    LDPOUT (&H3A)
1060    STOP
2000    OPENFLAG% = &HFF
2010    RETURN
```

5. **To activate/deactivate the audio channel at the designated frame number**

Example: 10000 10100 CH1 ON
10100 10200 CH2 ON
10200 CH1 and CH2 ON

```
10      _LDPOUT (&H46) :REM CH1 ON
20      _LDPOUT (&H49) :REM CH2 OFF
30      _LDPSTART (10000,10100,,,)
40      _LDPOUT (&H47) :REM CH1 OFF
50      _LDPOUT (&H48) :REM CH2 ON
60      _LDPSTART (10100,10200,,,)
70      _LDPOUT (&H46) :REM CH1 ON
80      _LDPOUT (&H3A)
```

ASSEMBLY LANGUAGE ROUTINES

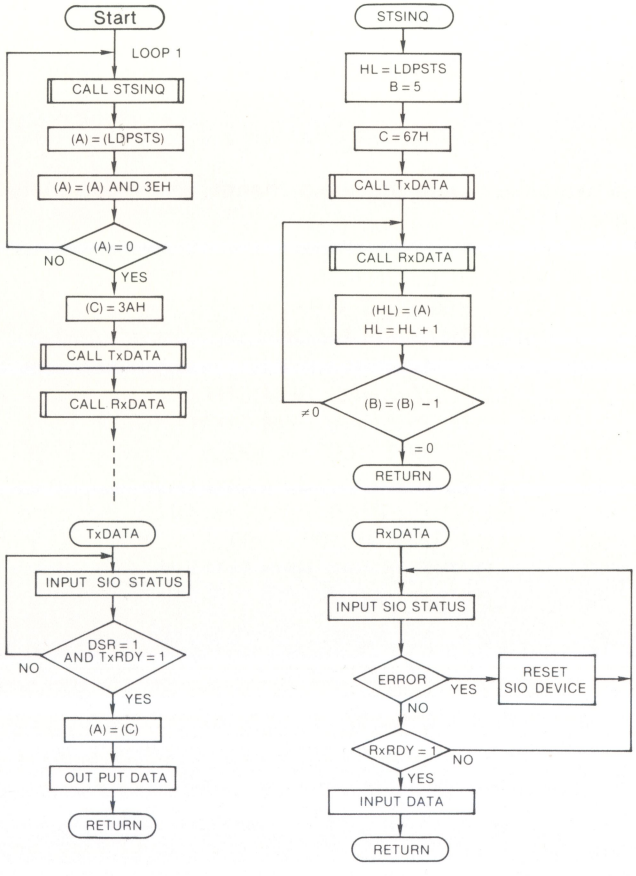
Flow charts and Z-80 assembly language routines to control the videodisc player via the RS-232C interface are provided below. These sample programs are for reference only. The actual programs you implement will depend on the microcomputer used and your particular programming requirements.

To initialize the RS-232C port of an external computer, refer to its operating manual.

1. To set the player in the PLAY mode after power on procedure

Player's status during power on procedure can be checked by sending the command STATUS INQ.

Flow chart

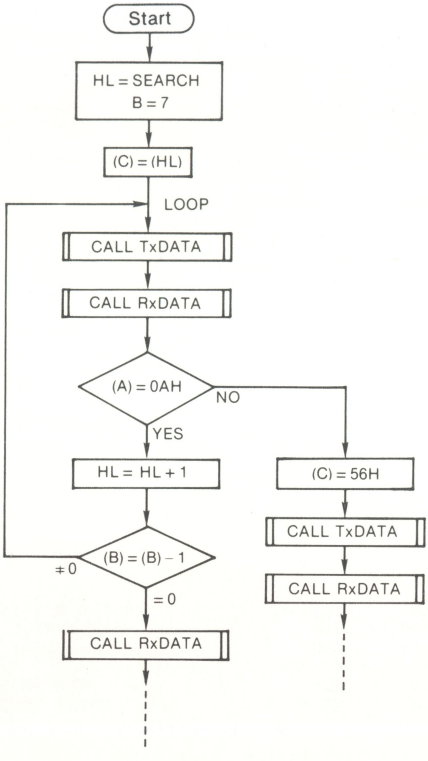


Program list

```
          .
          .
          .
LOOP1   CALL    STSINQ          ; WAIT UNTILL
        LD      A,[LDPSTS]      ;       MOTOR OFF FLAG=0
        AND     3EH             ;       INIT FLAG=0
        JP      NZ,LOOP1        ;       DISC PROP FLAG=0
        LD      C,3AH           ;       NO DISC FLAG=0
        CALL    TXDATA          ;       FOCUS FLAG=0
        CALL    RXDATA          ;    THEN SEND PLAY[3AH] CODE TO LDP
                                ;      AND RECEIVE HAND SHAKE RETURN
          .
          .
          .
          .
          .
;
; LDP STATUS RECEIVE PROGAM EXAMPLE
;
STSINQ  LD      HL,LDPSTS       ;
        LD      B,5             ;
        LD      C,67H           ; SEND STATUS INQUIRE[67H] CODE TO LDP
        CALL    TXDATA          ;
LOOP2   CALL    RXDATA          ; RECEIVE 5 STATUS DATA FROM LDP
        LD      [HL],A          ;
        INC     HL              ;
        DJNZ    LOOP2           ;
        RET                     ;
;
; DATA TRANSMITING PROGRAM EXAMPLE
;
TXDATA  IN      A,[27H]         ; TEST SIO STATUS
        AND     81H             ;  WAIT UNTILL
        XOR     81H             ;    DSR BIT=1 AND TXRDY BIT=1
        JP      NZ,TXDATA       ;
        LD      A,C             ; SET SEND CODE TO A-REG FROM C-REG
        OUT     [26H],A         ;   OUTPUT SEND CODE TO SIO
        RET                     ;
;
; DATA RECEIVING PROGRAM EXAMPLE
;
RXDATA  IN      A,[27H]         ; TEST SIO STATUS
        LD      C,A             ;  IF SOME ERROR [PE,OE,FE] RESET SIO
        AND     38H             ;
        JP      NZ,ERR          ;
        BIT     1,C             ;  WAIT UNTILL RXRDY BIT=1
        JP      Z,RXDATA        ;
        IN      A,[26H]         ; INPUT DATA
        RET                     ;
ERR     LD      A,37H           ;
        OUT     [27H],A         ;
        JP      RXDATA          ;
```

2. To SEARCH for frame number 10,000

Flow chart

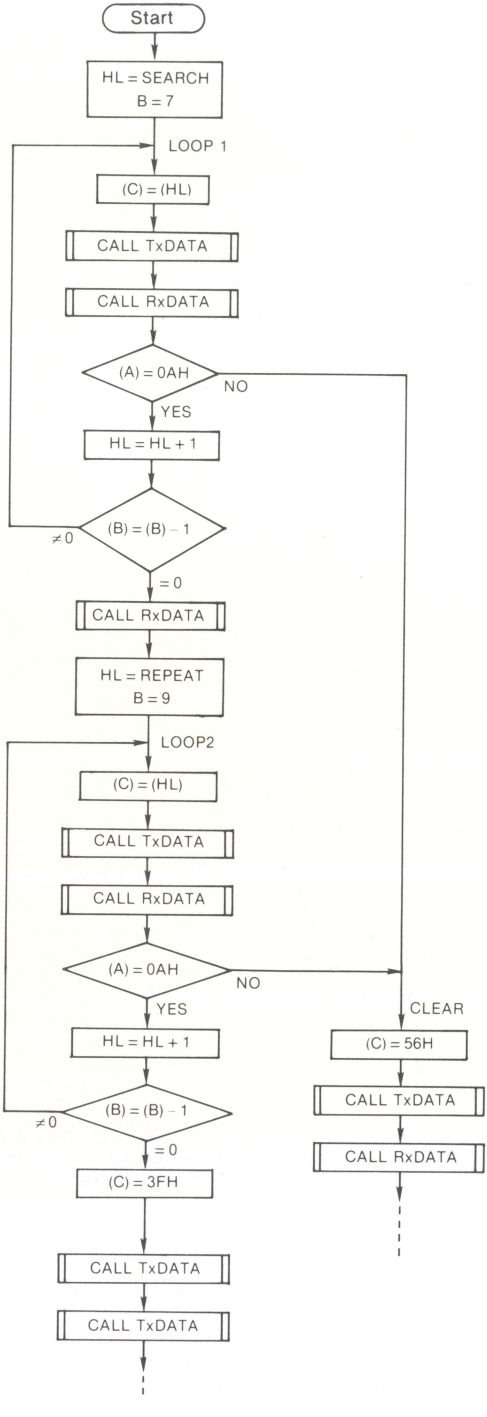


Program list

```
          .
          .
          .
          .
          .
          LD      HL,SEARCH       ; SEND [SEARCH 10000 ENTER] CODE TO LDP
          LD      B,7             ;   USING TXDATA SUBROUTINE
LOOP      LD      C,[HL]          ;
          CALL    TXDATA          ; EVETY TIME ONE CODE SEND
          CALL    RXDATA          ;   RECEIVE HAND CHAKE RETURN
          CP      0AH             ;  AND TEST ACKNOWREDGED
          JP      NZ,CLEAR        ;   NOT ACK.ED SEND CLEAR CODE
          INC     HL              ;
          DJNZ    LOOP            ;
          CALL    RXDATA          ; WAIT UNTILL SEARCH COPMLETION[01H]
          .
          .
          .
CLEAR     LD      C,56H           ; SEND CLEAR CODE[56H] TO LDP
          CALL    TXDATA          ;
          CALL    RXDATA          ;
          .
          .
          .
SEARCH    DEFB    43H,31H,30H,30H,30H,30H,40H    ; SERARCH 1 0 0 0 0 ENTER
          .
          .
          .
          .
```

3. To PLAY from frame 10,000 to 15,000 and STOP

Flow chart

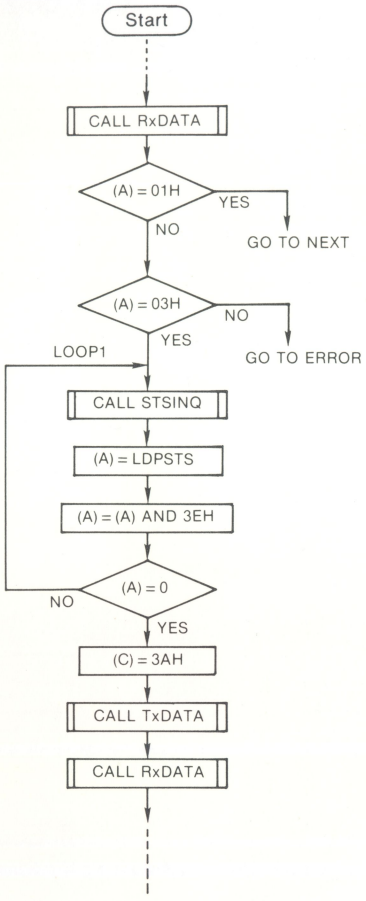


Program list

```
          .
          .
          .
          .
          LD      HL,SEARCH       ; SEND [SEARCH 1 0 0 0 0 ENTER] CODE
          LD      B,7             ;   USING TXDATA SUBROUTINE
LOOP1     LD      C,[HL]          ;
          CALL    TXDATA          ; EVERY TIME ONE CODE SEND
          CALL    RXDATA          ;  RECEIVE HAND SHAKE RETURN
          CP      0AH             ;   AND CHECK ACK.ED
          JP      NZ,CLEAR        ; IF NOT ACK.ED SEND CLEAR[56H] CODE
          INC     HL              ;
          DJNZ    LOOP1           ;
          CALL    RXDATA          ; WAIT UNTILL SEARCH COMPLETION
          LD      HL,REPEAT       ;
          LD      B,9             ;
LOOP2     LD      C,[HL]          ; SEND [REPEAT 1 5 0 0 0 ENTER 0 1 ENTER]
          CALL    TXDATA          ;
          CALL    RXDATA          ;
          CP      0AH             ;
          JP      NZ,CLEAR        ;
          INC     HL              ;
          DJNZ    LOOP2           ;
          CALL    RXDATA          ; WAIT UNTILL REPEAT PLAY COMPLETION[01H]
          LD      C,3FH           ; SEND LDP MUTE CODE[3FH]
          CALL    TXDATA          ;
          CALL    RXDATA          ;
          .
          .
          .
          .
CLEAR     LD      C,56H           ;
          CALL    TXDATA          ;
          CALL    RXDATA          ;
          .
          .
          .
SEARCH    DEFB    43H,31H,30H,30H,30H,30H,40H   ; SEARCH 10000 ENTER
REPEAT    DEFB    44H,31H,35H,30H,30H,30H,40H,31H,40H ; REPEAT 15000 ENTER
                  1 ENTER
```

4. To resume REPEAT PLAY if the lid of the disc compartment is opened during operation

Flow chart

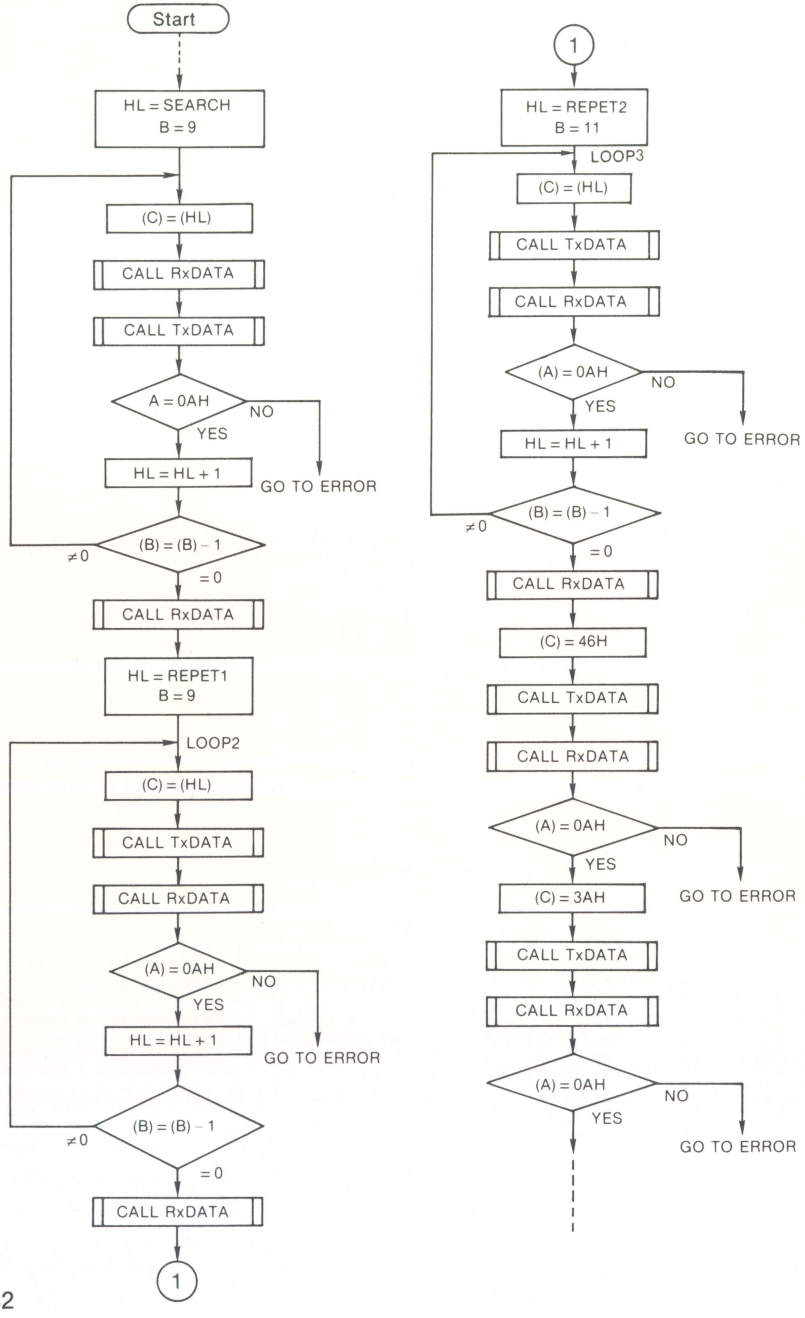


Program list

```
                                ;
                                ; REPEAT PLAYING
                                ;
                                ;
        CALL    RXDATA          ; WAIT COMPLETION
        CP      01H             ;   01H=END REPEAT PLAY
        JP      Z,NEXT          ;   03H=LID OPENED BEFORE REPEAT PLAY END
        CP      03H             ;   OTHERS...SOME ERROR HAPPENED
        JP      NZ,ERROR        ;
LOOP1   CALL    STSINQ          ; LID IS OPENED SO WAIT UNTILL CLOSED AGAIN
        LD      A,[LDPSTS]      ;  BY CHECKING LDP STATUS
        AND     3EH             ;
        JP      NZ,LOOP1        ;
        LD      C,3AH           ;  LID IS CLOSED SO SEND LDP PLAY[3AH] CODE
        CALL    TXDATA          ;
        CALL    RXDATA          ;
          .
          .
          .
          .
          .
NEXT    ......
        ......
        ......
ERROR   ......
        ......
        ......
```

5. **To activate/deactivate the audio channel at the designated frame number:** ex. frame 10,000—10,100 CH-1 ON
frame 10,100—10,200 CH-2 ON
frame 10,200— CH-1, CH-2 ON

Flow chart



Program list

```
                                    ; SEND AUDIO CH1 ON [46H] CODE
                                    ; SEND AUDIO CH2 OFF [49H] CODE
        LD      HL,SEARCH           ; SEND SEARCH 10000 ENTER CODE
        LD      B,9                 ;
LOOP1   LD      C,[HL]              ;
        CALL    TXDATA              ;
        CALL    RXDATA              ;  EVERY TIME ONE CODE SEND
        INC     HL                  ;      RECEIVE HAND SHAKE RETURN
        CP      0AH                 ;
        JP      NZ,ERROR            ;
        DJNZ    LOOP1               ;
        CALL    RXDATA              ; WAIT SERACH COMPLETION [01H]
        LD      HL,REPET1           ;
        LD      B,9                 ; SEND REPEAT 10100 ENTER CODE
LOOP2   LD      C,[HL]              ;
        CALL    TXDATA              ;
        CALL    RXDATA              ;  EVERY TIME ONE CODE SEND
        INC     HL                  ;      RECEIVE HAND SHAKE RETURN
        DJNZ    LOOP2               ;
        CALL    RXDATA              ; WAIT REPREAT PLAY END
        LD      HL,REPET2           ;  SWITCH AUDIO CHANNEL
        LD      B,11                ;     CH1  OFF    CH2  ON
LOOP3   LD      C,[HL]              ;  REPEAT 10200
        CALL    TXDATA              ;
        CALL    RXDATA              ;
        CP      0AH                 ;
        JP      NZ,ERROR            ;
        INC     HL                  ;
        DJNZ    LOOP3               ;
        CALL    RXDATA              ; WAIT REPEAT PLAY END
        LD      C,46H               ;   SWITCH AUDIO CHANNEL
        CALL    TXDATA              ;     CH1  ON
        CALL    RXDATA              ;
        CP      0AH                 ;
        JP      NZ,ERROR            ;
        LD      C,3AH               ; SEND PLAY [3AH] CODE TO LDP
        CALL    TXDATA              ;
        CALL    RXDATA              ;
        CP      0AH                 ;
        JP      NZ,ERROR            ;

SEARCH  DEFB    46H,49H ; CH1 ON,CH2 OFF
        DEFB    43H,31H,30H,30H,30H,30H,40H ; SEARCH 10000 ENTER
REPET1  DEFB    44H,31H,30H,31H,30H,30H,40H,31H,40H ; REPEAT 10100 ENTER 1 ENTER
REPET2  DEFB    47H,48H ; CH1 OFF,CH2 ON
        DEFB    44H,31H,30H,32H,30H,30H,40H,31H,40H ; REPEAT 10200 ENTER 1 ENTER
```

Chapter 4
Appendix

REFERENCE TABLE OF SONY VIDEODISC PLAYERS

COMMANDS

	LDP-1500 series	LDP-2000 series	LDP-1000A	LDP-180 series + IF-180
Power on	No return code. Communication is possible just after power is on.	Same as LDP-1500 series	Player returns ACK (0AH) twice. Communication is impossible before the player returns the second ACK.	Player returns ACK (0AH) twice. Communication is impossilbe before the player returns the 1st ACK.
MOTOR ON (62H)	It is executable when the motor is off. The player returns ACK (0AH) twice. If no disc is loaded when the command is sent, the player returns NOT TARGET (05H) instead of 2nd ACK. Communication is always possible.	It is executable when the motor is off. The player returns ACK (0AH) twice. Communication is always possible.	It is executable when the motor is off. The player returns ACK (0AH) twice. Communication is impossilbe before the player returns the 2nd ACK.	It is executable when the motor is off. The player returns ACK (0AH) twice. Communication is impossible before the player returns 1st ACK.
MOTOR OFF (63H)	It is executable when the motor is on. The player returns ACK (0AH) twice. Communication is always possible.	Same as LDP-1500 series	It is excutable when the motor is on. The player returns ACK (0AH) once after the motor is stopped. Only STATUS INQ is acceptable before ACK is returned.	Same as LDP-1500 series
NAK (0BH)	It is returned when the player rejects the command sent. For a command which returns ERROR in the LDP-2000 series, NAK is returned and ERROR flag is set. Error status is cleared when the correct commnad is input.	It is returned when the received command is not acceptable.	Same as LDP-2000 series	Same as LDP-2000 series
ERROR (02H)	It is returned when communication error occurs.	It is returned when the recieved command is against communication protocol. Once being in error, any command can't be accepted until the CL command is input.	Same as LDP-2000 series	Same as LDP-2000 series

	LDP-1500 series	LDP-2000 series	LDP-1000A	LDP-180 series + IF-180
ADDR INQ (67H)	The address represented by 5 bytes of ASCII code is returned. If the player is in motor-off, no disc or initialization mode, NAK (0BH) is returned.	Same as LDP-1500 series	The address represented by 5 bytes of ASCII code is returned. If address is not found, 30H is returned in 5 bytes (5 times).	Same as LDP-1500 series except that the last address is returned when the player is in lead-in or lead-out area.
LID OPEN in EXT CPU mode	LID OPEN (03H) is returned. Communication is always possible.	Same as LDP-1500P series	No return code. Only STATUS INQ is acceptable.	LID OPEN (03H) is returned. Communication is impossible during 300 ms after 03H is returned.
LID CLOSE in EXT CPU mode	No return code. Communication is always possible.	Same as LDP-1500 series	The player returns ACK (0AH) twice. Communication is impossible before the player returns the 2nd ACK.	The player returns ACK (0AH) twice. Communication is impossible before the player returns the 1st ACK.
INDEX (66H)	NAK (0BH)	Turns index on, changes index from frame to chapter and turns index off.	Same as LDP-2000 series	NAK (0BH)
INDEX ON (50 H)	Activates index function in the current mode.	Always displays frame (or time) number.	Same as LDP-2000 series	Frame (or time) and chapter numbers are displayed at the same time.
INDEX OFF (51H)	Deactivates the current index funciton.	Turns off the frame number display.	Same as LDP-2000 series	Turns off the frame (or time) and chapter numbers display.
MODE (5FH)	NAK (0BH)	Changes access mode for search and repeat operations. It must be input after SEARCH or REPEAT command.	Same as LDP-2000 series	NAK (0BH)
FRAME # MODE (55H)	Changes the index display mode and access mode to frame number mode. The command can be accepted at any time except when the player is in search or repeat operation with number mode other than frame number.	Changes the access mode for search and repeat to frame number mode. It must be input before SEARCH or REPEAT command.	Same as LDP-2000 series	Same as LDP-2000 series

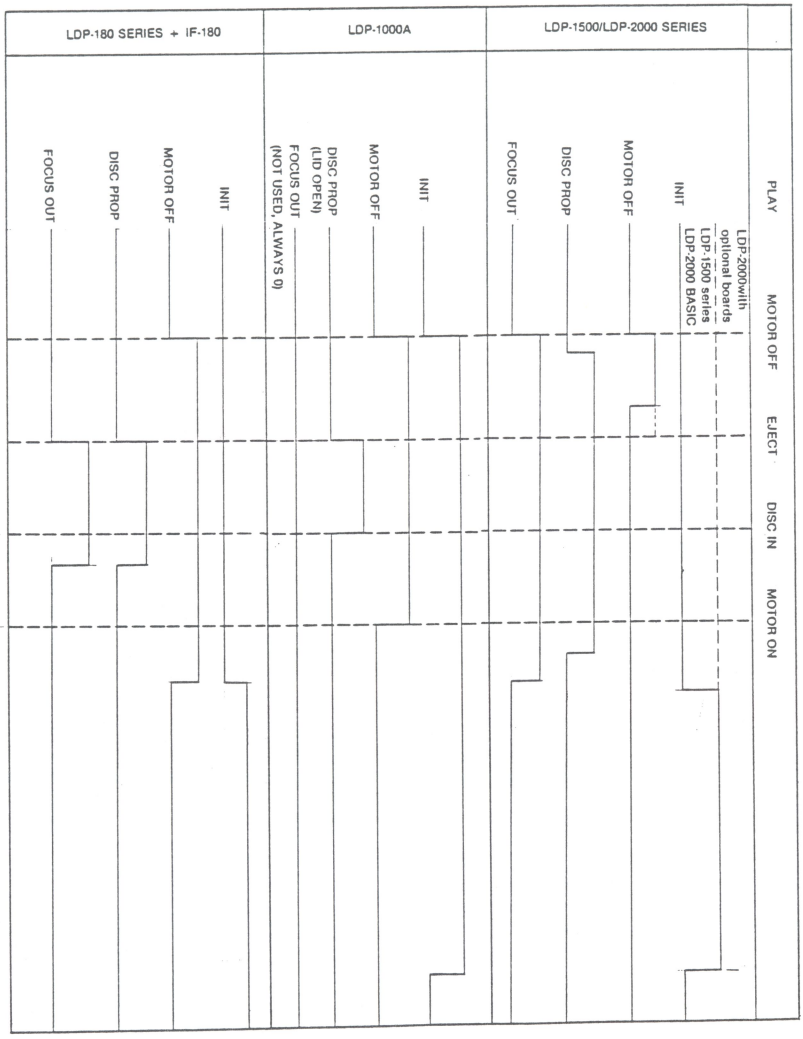
	LDP-1500 series	LDP-2000 series	LDP-1000A	LDP-180 series + IF-180
CHAPTER # MODE (69H)	Changes index display mode and access mode for search and repeat to chapter number mode. It can be accepted except when the player is in search or repeat operation with number mode other than chapter number.	Changes access mode for search or repeat to chapter number mode. It must be input before SEARCH or REPEAT command.	Same as LDP-2000 series	Same as LDP-2000 series.
MEMORY (5AH)	Memorizes the current location with frame or time number when the player is in the frame number mode and with chapter number when in the chapter number mode.	Memorizes the current location with frame number for a CAV disc and with time number for a CLV disc.	Same as LDP-2000 series	Same as LDP-2000 series
MEMORY SEARCH (5BH)	Searches for memoried location by MEMORY. After searching, the same mode as the one memorized will be resumed.	Searches for frame (or time) number memorized. After searching, the frame number mode will be resumed.	Same as LDP-2000 series	Same as LDP-2000 series
MENU (42H)	Playback begins from the top of the program.	NAK with LDP-2000/1. For LDP-2000/2 to/5 (V2.2), the first program is played back when a disc with audio track control code is used or such program is dumped in. (Same as LDP-1000A with V2.0 and V2.1)	The first program is played back when a disc with audio track control code is used. If a disc does not have audio track control code, the player stills at frame number1.	NAK (0BH)
CX (70H)	NAK (0BH)	Changes CX ON and CX OFF in toggle sequence.	Same as LDP-2000 series	Same as LDP-2000 series
CH1 (64H)	NAK (0BH)	Changes AUDIO CH1 on and off in toggle sequence.	Same as LDP-2000 series	NAK (0BH)
CH2 (65H)	NAK (0BH)	Changes AUDIO CH2 on and off in toggle sequence.	Same as LDP-2000 series	NAK (0BH)
AUDIO MUTE OFF (25H)	Deactivates audio mute while the player is in R-PLAY, SLOW, FAST, STEP and SCAN.	Deactivates the audio mute at any time.	NAK (0BH)	NAK (0BH)

PLAYER'S STATUS

Status data	LDP-1500 series	LDP-2000 series	LDP-1000A	LDP-180 series + IF-180
1st byte				
D7	1		0	1
D6	Search, repeat mode		Search, repeat mode [3]	Search, repeat mode
D5	Motor off mode		Motor off mode	Motor off mode
D4	INIT flag	Same as LDP-1500	INIT flag	INIT flag
D3	Disc prop	series	Disc prop	Lid open (disc prop)
D2	No disc		] 0	No disc
D1	Focus out			Focus out
D0	Error		Error	Error
2nd byte				
D7	]	] 0	0	]
D6			PGM memory search [1]	
D5			PGM wait mode [1]	
D4		PGM wait mode [1]	PGM decimal mode [1]	
D3	0	PGM decimal mode [1]	PGM initial mode [1]	0
D2		PGM initial mode [1]	PGM display mode [1]	
D1		PGM display mode [1]	PGM execute mode [1]	
D0	]	PGM execute mode [1]	PGM input mode [1]	]
		PGM input mode [1]		
3rd byte				
D7	0	PGM mode [1]	PGM mode [1]	0
D6	Extended code	0	Native mode	Native mode
	Yes (1)/No(0)			
D5	CLV (1)/CAV(0)	CLV (1)/CAV (0)	]	CLV (1)/CAV(0)
D4	12" (1)/8"(0)	12" (1)/8" (0)		
D3	]	]		]
D2			0	
D1	0	0		0
D0	]	]	]	]
4th byte				
D7	Step # input	Step # input	Step # input	Step # input
D6	0	PGM execute # input [1]	PGM execute # input [1]	]
D5	Repeat time input	Repeat time input	0	
D4	0	Segment # input [1]	Segment # input [1]	0
D3	Picture stop code	Picture stop code	Picture stop code	]
D2	Repeat mode	Repeat mode [2]	Repeat mode	Repeat mode
D1	Search mode	Search mode [2]	Search mode	Search mode
D0	Number input	Number input	Number input	Number input
5th byte				
D7	REV (1)/FWD (0)		REV (1)/FWD (0)	REV (1)/FWD (0)
D6	STOP		STOP	STOP
D5	STILL		0	STILL
D4	SCAN	Same as LDP-1500	SCAN	0
D3	STEP	series	STEP	STEP
D2	SLOW		SLOW	SLOW
D1	FAST		FAST	FAST
D0	PLAY		PLAY	PLAY

1) Status is "0" if the series are not provided with the audio track control function.
2) This flag is reset when the ENTER command is input at the end of the search or repeat input sequence.
3) This flag is set when the SEARCH or REPEAT command in input and remains until the operation ends or the flag is reset with the C.L. command. (On the LDP-2000 series, the flag is set while the player is actually executing the search or repeat operation.)

Status flag timing chart



VIDEODISC

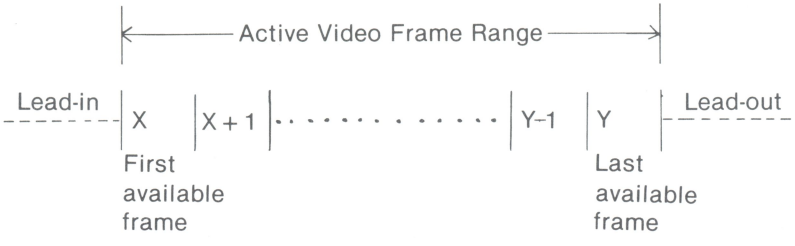
CAV format

The CAV (constant angular velocity) disc always rotates at a constant speed and the laser beam moves from the inner part of the disc to the outer. A maximum of 54,000 frames can be recorded on each side of a disc. Each frame of the playback picture is recorded on one track and is reproduced in one rotation. The frame number is recorded on the track.
A series of frames can be played back in various speed modes such as fast, slow, step by step or even still frame both in forward and reverse directions.
Using the frame number as reference, quick access on a disc or repeat playback of the specified area can be controlled by an external computer. This unique feature makes it possible for users to develop unique application programs.

CLV format

A CLV (constant linear velocity) disc rotation speed varies so that a constant linear velocity is maintained on the whole disc recording surface. Time codes which indicate the elapsed playback time are used on a CLV disc in place of frames with a CAV disc. As a consequence, only normal playback and scan mode are available as playback mode and search and repeat operation are performed on a time code base.

LAYOUT OF VIDEO FRAMES



X is the first available video frame. Anything before X is denominated as lead-in and is not accessible by the external computer.
Y is the last available video frame. Anything after Y is denominated as lead-out and is not accessible by the external computer.
Thus the active video frame range falls between X and Y, inclusive.

Notes

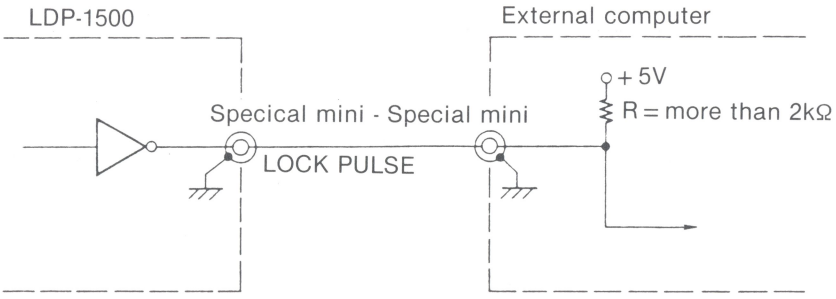
- The AUTO REPEAT ON/OFF switch is located on the player. When in the ON position and the player enters the lead-out area, it will go back to the beginning of the disc and play. However, if under external computer control and the player enters the lead-out area, it will go back to the lead-in area and go into STOP mode at the beginning of the active video area.
- For whatever reason if a player enters the lead-in area (e.g., R-PLAY), the player will begin to play at the beginning of the active video area. Under external computer operation, the player will go into STOP mode at the beginning of the active video area.

NOTE ON LOCK PULSE JACK

(only for NTSC model)

This jack supplies the lock pulse signal to an external computer when superimposing video signals from the external microcomputer and the player using the optional video superimposer. The computer's video signal is synchronized with the lock pulse signal from the player. As result, a stable superimposed picture can be obtained over the playback picture in the still, slow or fast mode of the player.
When a Sony SMC-70 microcomputer is used, connect the SMI-7073 RGB superimposer or SMI-7074 NTSC superimposer to this LOCK PULSE jack, using a special mini to special mini cable. If this kind of cable is not available, consult your authorized Sony representative.

If you connect a superimposer other than those mentioned above, follow the instruction below:



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